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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/767,107	01/28/2004	Ray R. Eshraghi	4172-121	4423

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INTELLECTUAL PROPERTY / TECHNOLOGY LAW  
PO BOX 14329  
RESEARCH TRIANGLE PARK, NC 27709

EXAMINER
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CHUO, TONY SHENG HSIANG

ART UNIT	PAPER NUMBER
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1746

DATE MAILED: 05/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/767,107	ESHraghi ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Tony Chuo	1746	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-47 is/are pending in the application.
- 4a) Of the above claim(s) 31-47 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                                                                              |                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                                                  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                                         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>4/29/04</u> . | 6) <input type="checkbox"/> Other: ____.                                                |

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
  - I. Claims 1-30, drawn to a gas storage and dispensing system, classified in class 96, subclass 8.
  - II. Claims 31-35, drawn to a hydrogen generation catalyst, classified in class 502, subclass 100.
  - III. Claims 36-47, drawn to a fuel cell, classified in class 429, subclass 31.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the gas storage and dispensing system does not require the particulars of the hydrogen generation catalyst. The subcombination has separate utility such as generating hydrogen by itself.

Inventions I and III are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different designs, modes of operation, and effects (MPEP § 802.01 and § 806.06). In the instant case, the different inventions are a gas storage and dispensing system and a microfibrous fuel cell.

Inventions II and III are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different designs, modes of operation, and effects (MPEP § 802.01 and § 806.06). In the instant case, the different inventions are a hydrogen generation catalyst and a fuel cell.

Because these inventions are independent or distinct for the reasons given above and have acquired a separate status in the art in view of their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are independent or distinct for the reasons given above and the inventions require a different field of search (see MPEP § 808.02), restriction for examination purposes as indicated is proper.

During a telephone conversation with Mr. Steven Hultquist on 5/1/06 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-30. Affirmation of this election must be made by applicant in replying to this Office action. Claims 31-47 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

### ***Specification***

2. The disclosure is objected to because of the following informalities: on page 18 paragraph [0076] and page 19 paragraph [0077], the phrase "headspace 32B" should be changed to "headspace 32A", on page 20 paragraph [0084], the phrase "headspace 42B" should be changed to "headspace 42A", on page 23 paragraphs [0095] & [0096], the phrase "liquid hydrogen carrier 54" should be changed to "liquid hydrogen carrier 53". Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 11 recites the limitation "carrier material" in storage and dispensing system. There is insufficient antecedent basis for this limitation in the claim. Claim 11 appears to be dependent upon claim 10.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-7 are rejected under 35 U.S.C. 102(a) (e) as being anticipated by Shapovalov et al (US 2002/0069929). Regarding claims 1 and 2, the Shapovalov reference teaches a storage and dispensing system for storing and dispensing a target gas comprising: a housing "1"; a plurality of microtubular elements "2" disposed in housing wherein each of the microtubular elements comprises a tubular wall defining a bore side and a shell side, and wherein the bore side is sealed from the shell side; and a carrier material for target gas wherein carrier material is disposed in housing at the bore side of microtubular elements (See Figure 4 and paragraphs

[0049],[0052],[0053],[0055]). Regarding claims 3-6, it also teaches the carrier material, gasars, comprising a physical sorbent material that is made of an amorphous metal composition having sorptive affinity for the target gas which is hydrogen (See paragraphs [0055],[0057]). Regarding claim 7, it also teaches cell walls of the microtubular elements that are impermeable to the target gas (See paragraph [0053]).

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shapovalov et al (US 2002/0069929) in view of Suda (US 6358488). The Shapovalov reference is applied to claims 1-7 for reasons stated above. However, the reference does not expressly teach a liquid carrier material comprising at least one material selected from the group consisting of liquefied hydrogen, organic hydrogen solvents, and metal hydride solutions. The Suda reference teaches a liquid carrier material comprising a metal hydride solution such as sodium borohydride (See Abstract). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Shapovalov storage and dispensing system to include a liquid carrier material comprising sodium borohydride because generating hydrogen gas from sodium borohydride solution is safe and easily controlled.

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9. Claims 10-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shapovalov et al (US 2002/0069929) in view of Masada et al (US 2002/0056370). The Shapovalov reference is applied to claims 1-7 for reasons stated above. However, the reference does not expressly teach a carrier material that is disposed at the shell sides of the microtubular elements and tubular walls that are permeable to the target gas. The Masada reference teaches a carrier material that is disposed at the shell sides of microtubular elements "1" and tubular walls that are permeable to the target gas (See Figure 2 and paragraph [0041]). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Shapovalov storage and dispensing system to include a carrier material that is disposed at the shell sides of the microtubular elements and tubular walls that are permeable to the target gas in order to maximize the total volume of hydrogen adsorbed and released by the carrier material.

10. Claims 16-18, 22-26, and 29-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shapovalov et al (US 2002/0069929) in view of Masada et al (US 2002/0056370) as applied to claims 10-15 above and further in view of Suda (US 6358488). In addition, the Shapovalov reference also teaches microtubular elements "2" that are potted at one end by potting member "4" so that the bore sides of microtubular elements are sealed from the shell sides by the potting member in a leak tight manner wherein the potting member and the housing define a compartment for holding the carrier material and a hydrogen collection compartment "6" separated from the carrier material compartment in a leak tight manner wherein the microtubular

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elements extend from the carrier material compartment to the hydrogen collection compartment so that the shell sides of the microtubular elements at least partially contact the carrier material in carrier material compartment and the bore sides of the microtubular elements are in fluid communication with hydrogen collection compartment and wherein the housing comprises a hydrogen outlet connected to hydrogen collection compartment for dispensing hydrogen gas (See Figure 4). However, the references do not expressly teach a liquid carrier material comprising at least one material selected from the group consisting of liquefied hydrogen, organic hydrogen solvents, and metal hydride solutions, a metal hydride solution that comprises  $\text{NaBH}_4$  at a concentration of 10-35%  $\text{NaBH}_4$  by total weight and 2-4%  $\text{NaOH}$  by total weight, a catalyst-based hydrogen release control mechanism associated with the liquid compartment, pH-based hydrogen release control mechanism associated with the liquid compartment, or a catalyst layer in the tubular walls of microtubular elements. The Suda reference teaches a liquid carrier material comprising a sodium borohydride solution at a concentration of 10%  $\text{NaBH}_4$  by total weight and 2%  $\text{NaOH}$ , a catalyst material brought into contact with the sodium borohydride solution to generate hydrogen, and increasing the pH of the solution to stabilize the sodium borohydride and control the rate of hydrogen gas evolution (See column 4, lines 13-18 and Reference Example 1). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Shapovalov storage and dispensing system to include a metal hydride solution that comprises  $\text{NaBH}_4$  at a concentration of 10%  $\text{NaBH}_4$  by total weight and 2%  $\text{NaOH}$  by total weight, a catalyst-based hydrogen release control

mechanism associated with the liquid compartment comprising a layer of catalyst material in the tubular walls of the microtubular elements or a pH-based hydrogen release control mechanism associated with the liquid compartment in order to safely and easily generate hydrogen gas from a liquid carrier material.

11. Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shapovalov et al (US 2002/0069929) in view of Masada et al (US 2002/0056370) and Suda (US 6358488) as applied to claims 16-18, 22-26, and 29-30 above and further in view of Holland et al (US 6572837). However, the references do not expressly teach tubular walls of the microtubular elements comprising a membrane material that is gas permeable but liquid impermeable, a membrane material comprising a microporous hydrophobic polymeric material, or tubular walls of the microtubular elements comprising a first layer of structural material that is gas and liquid permeable and a second layer of membrane material that is gas permeable but liquid impermeable. The Holland reference teaches a hydrogen separation membrane comprising a microporous hydrophobic polymer that is gas permeable but liquid impermeable or a composite membrane that comprises a gas and liquid permeable layer and a gas permeable liquid impermeable layer (See column 8, lines 55-67). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Shapovalov storage and dispensing system to include tubular walls of the microtubular elements comprising a hydrogen separation membrane comprising a microporous hydrophobic polymer that is gas permeable but liquid impermeable or a composite membrane that comprises a gas and liquid permeable layer and a gas permeable liquid

impermeable layer in order to efficiently generate hydrogen gas from the liquid carrier material.

12. Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shapovalov et al (US 2002/0069929) in view of Masada et al (US 2002/0056370) and Suda (US 6358488) as applied to claims 16-18, 22-26, and 29-30 above and further in view of Gottesfeld (US 2003/0031907). However, the references do not expressly teach a hydrogen fuel cell assembly comprising a water management mechanism for removing water generated during the electrochemical reaction from assembly wherein the water supply of the storage and dispensing system is connected to the water management mechanism of the hydrogen fuel cell assembly so that the water generated by hydrogen fuel cell assembly is controllably added to the liquid compartment of the storage and dispensing system. The Gottesfeld reference teaches a hydrogen fuel cell assembly "2" comprising a water management mechanism including line "38", water tank "16", and valve "26A" (See Figure 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Shapovalov storage and dispensing system to replace the mixing chamber of the Gottesfeld fuel cell system so the water supply of the storage and dispensing system is connected to the water management mechanism of the fuel cell system so that water generated by the fuel cell system is controllably added to the liquid compartment of the storage and dispensing system in order to utilize the Shapovalov storage and dispensing system in a practical application and efficiently manage the water generated by the fuel cell system.

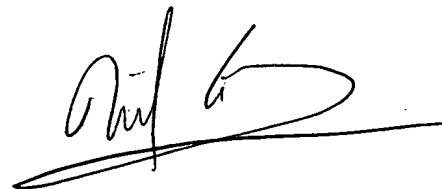
***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tony Chuo whose telephone number is (571) 272-0717. The examiner can normally be reached on M-F, 8:30AM to 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on (571) 272-1414. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TC

A handwritten signature in black ink, appearing to read 'Michael Barr', with a long horizontal stroke extending to the right.

**MICHAEL BARR  
SUPERVISORY PATENT EXAMINER**